Wing Kam Liu

Walter P. Murphy Professor of Mechanical Engineering
Director of Global Center on Advanced Material Systems and Simulation
President of the International Association for Computational Mechanics
Past Chair of the US National Committee on Theoretical and Applied Mechanics within the National Academies
Member, Board of International Scientific Organizations within the US National Academies
Founding Chairman of the ASME NanoEngineering Council
Founding Director of the NSF Summer Institute on Nano Mechanics, Nano Materials and Micro/Nano Manufacturing
Founding Director of the NU Master of Science Specialization in Simulation-driven Engineering
Founding Co-Director of the NU Predictive Science and Engineering Design Program

Northwestern University
Robert R. McCormick School of Engineering and Applied Science
Department of Mechanical Engineering
2145 Sheridan Road
Evanston, IL 60208-3111

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Education
Ph.D., California Institute of Technology, June, 1981, (completed August, 1980)
M.S., California Institute of Technology, June, 1977
B.S., Engineering Science (with highest honors)
University of Illinois at Chicago Circle, June, 1976

Professional Registration
Registered Professional Engineer, State of Illinois License No-- 062-041222, 1983-

Professional and Honor Societies
American Society of Mechanical Engineers (ASME) Fellow
American Society of Civil Engineers (ASCE) Fellow
American Academy of Mechanics (AAM) Fellow
United States Association for Computational Mechanics (USACM) Fellow
International Association for Computational Mechanics (USACM) Fellow

Academic Awards
1976-1980 Tuition scholarship, California Institute of Technology
1974-1976 Tuition scholarship, University of Illinois at Chicago Circle

Editors and Editorial Boards
Editor of Computational Mechanics
Editor of Asia Pacific Journal on Computational Engineering
Honorary Editor-in-chief of the International Journal of Computational Methods
Honorary Editor of International Journal of Computational Methods
Editorial Board, International Journal for Numerical Methods in Engineering, 2001-
Advisory Board, Computer Methods in Applied Mechanics and Engineering, 1997-
Editorial Board, Advanced Modeling and Simulation in Engineering Sciences, 2012-
Associate Editor, Journal of Applied Mechanics, ASME, 1993-1999
Associate Editor, Journal of Pressure Vessel Technology, ASME, 1989-1995
Associate Editor, Journal of Engineering Mechanics, ASCE, 1988-1990

Awards/Honors

2016 International Computational Methods Medal of the International Conference on Computational Methods

2014-2018 President of the International Association for Computational Mechanics

2014-2016 Chair of the US National Committee on Theoretical and Applied Mechanics within the National Academies

2014 highly cited researcher in the field of Computer Science and listed as a member of the World's Most Influential Scientific Minds by Thompson Reuters for the period 2002 through 2012. Researchers earned the distinction by writing the greatest number of papers in the top 1% in their fields during the year of publication, "earning them the mark of exceptional impact."

2013 Japan Society for Computational Engineering and Science **(JSCES) Grand Prize** in recognition of your outstanding contributions in the field of computational mechanics awarded on June 12, 2014 in Hiroshima, Japan.

2013, **Honorary Professorship** of Dalian University of Technology (this title is similar to an Honorary Doctor's Degree), conferred on March 10-13, 2014.

International Association for Computational Mechanics (IACM), **Gauss-Newton Medal** (IACM Congress Medal), the highest award given by IACM, 2012

Best Paper Award sponsored by Ford Motor Company at the **2012** ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference.

ASME Dedicated Service Award for dedicated voluntary service to the society marked by outstanding performance, demonstrated effective leadership, prolonged and committed service, devotion, enthusiasm, and faithfulness, **2009**

ASME Robert Henry Thurston Lecture Award, **2007**

U. S. Association for Computational Mechanics, **John von Neumann Medal**, the highest award given by USACM, **2007**

Japan Society of Mechanical Engineers **Computational Mechanics Award**, **2004**

International Association for Computational Mechanics, **Computational Mechanics Award**, **(2002)**

Cited by Institute for Scientific Information (ISI) **(2001)** as **one of the most highly cited, influential researchers in Engineering, and an original member**, highly cited researchers database

USACM, **Computational Structural Mechanics Award, (2001)**

ASME **Gustus L. Larson Memorial Award (1995)**

Thomas J. Jaeger Prize, Int. Association for Structural Mechanics in Reactor Technology **(1989)**

ASME **Pi Tau Sigma Gold Medal (1985)**

Ralph R. Teetor Educational Award, American Society of Automotive Engineers (1983)

ASME **Melville Medal (1979)**

2017- Director of Advanced Material Systems and Simulations Global Collaboratory

2016- Director of International Research Center for Computational Mechanics at Dalian University of Technology

2015- Member, Board of International Scientific Organizations within the US National Academies

2014-2018 President of the International Association for Computational Mechanics

2014-2016 Chair of the US National Committee on Theoretical and Applied Mechanics within the National Academies

2015- Chair Professor of Peking University, Program for Overseas Professionals (Thousand Talent Project)

2013-2015 Advisory Council Member for the Committee on Credible Practice of Modeling & Simulation in Healthcare, Interagency Modeling and Analysis Group Multiscale Modeling Consortium, (https://simtk.org/home/cpms)

2013-2015 Adjunct Professor under the Distinguished Scientists Program Committee at King Abdulaziz University (KAU), Jeddah, Saudi Arabia
2012-2014 (Vice Chair) (2014, Chair) of the US National Committee on Theoretical and Applied Mechanics within the National Academies (Elected)
2010- Present Vice President of the International Association for Computational Mechanics (Elected)
2009- Present Sung Kyun Kwan University Visiting Distinguished World Class University Professor
2007- Founding Chairman of the ASME Wide Nanotechnology Council
2007- Member at Large of the US National Council Theoretical and Applied Mechanics
2007**-** 2009 Sung Kyun Kwan University Advanced Institute of Nanotechnology (SAINT) Visiting Chair Professor
2005 Chair, executive committee of Applied Mechanics Division of ASME (Member 2001-2006)
Member of ASME Robert Henry Thurston Lecture Award, 2010 - present
Member of ASME AMD Timoshenko Medal Committee, 2001 - 2010
Member of ASME AMD Warner T. Koiter Medal Committee, 2001 – 2010
Member of ASME AMD Daniel C. Drucker Medal Committee, 2001 – 2010
Member of ASME AMD Thomas J. R. Hughes Young Investigator Award Committee, 2001 – 2010
Member of ASME AMD Ted Belytschko Applied Mechanics Award Committee, 2001 – 2010
Member of ASME AMD Thomas K. Caughey Dynamics Award Committee, 2007 – 2010
2003 Founding Director of the NSF Summer Institute on Nano Mechanics and Materials
2003-present Member of the executive committee of the International Association for Computational Mechanics (Elected)
2001-2003 Chairman of the Engineering Panel of the Research Grants Council of Hong Kong, China
2000-2002 President, U. S. Association for Computational Mechanics
2000-2001 Visiting Nanyang Professor, Nanyang Technological University, Singapore
1997 General Chairman of McNU'97 held at Northwestern University (more than 1000 participants)
1990 Fellow of American Society of Mechanical Engineers (ASME)
1993 Fellow of American Society of Civil Engineers (ASCE)
1995 Fellow of U. S. Association for Computational Mechanics (USACM)
1997 Fellow of American Academy of Mechanics (AAM)
1998 Fellow of International Association for Computational Mechanics (IACM)
1980 Listed in Who's Who in Engineering, Engineers Joint Council of U.S.A.
1981 Listed in Who's Who in Technology Today, U.S.A.
1981 Listed in Outstanding Young Men of America
1982 Listed in International Who's Who in Engineering
1985 Listed in Who's Who in Frontier Science and Technology, U.S.A.
1985 Listed in Men of Achievement, Great Britain
1985 Listed in International Who's Who of Contemporary Achievement, Great Britain
1986 Listed in American Men and Women of Science
1992 Listed in Who's Who in Midwest
1992 Listed in Who's Who in America
1994 Listed in Who's Who's Among Asian Americans
1995 Listed in American Men and Women of Science
1995 Listed in Who's Who in the World

Professional and Administrative Experience
2017- Director of Advanced Material Systems and Simulations Global Collaboratory
2016- Director of International Research Center for Computational Mechanics at Dalian University of Technology

2015- Chair Professor of Peking University, Program for Overseas Professionals (Thousand Talent Project)
2014-2018 President of the International Association for Computational Mechanics
2014-2016 Chair of the US National Committee on Theoretical and Applied Mechanics within the National Academies
2013-2015 Advisory Council Member for the Committee on Credible Practice of Modeling & Simulation in Healthcare, Interagency Modeling and Analysis Group Multiscale Modeling Consortium, (https://simtk.org/home/cpms)
2013-2015 Adjunct Professor under the Distinguished Scientists Program Committee at King Abdulaziz University (KAU), Jeddah, Saudi Arabia
2012-2014 (Vice Chair) of the US National Committee on Theoretical and Applied Mechanics within the National Academies (Elected)
2010-2014 Vice President of the International Association for Computational Mechanics (Elected)
2009 ASME Dedicated Service Award for dedicated voluntary service to the society marked by outstanding performance, demonstrated effective leadership, prolonged and committed service, devotion, enthusiasm, and faithfulness
2009-2013 Sung Kyun Kwan University Visiting Distinguished World Class University Professor
2007- Founding Chairman of the ASME Wide NanoEngineering Council and Founder and Co-Chairman of the First World Congress on NanoEngineering for medicine and biology (NEMB2010): Advancing Health Care through NanoEngineering and Computing (http://www.asmeconferences.org/nemb2010/) (Feb 7-10, 2010, Houston, TX)
2007-2012 Member at Large of the US National Council Theoretical and Applied Mechanics
2007**-** 2013 World Class University Professor (2008-2013) at Sung Kyun Kwan University (SKKU) Advanced Institute of Nanotechnology (SAINT) Distinguished Visiting Chair Professor
2003- Walter P. Murphy Professor of Mechanical Engineering
2008-2013 Co-Director (Founding Director till 2008) of the NSF Summer Institute on Nano Mechanics and Materials
2003 Founding Director of the NSF Summer Institute on Nano Mechanics and Materials
2003-present Member of the executive committee of the International Association for Computational Mechanics (Elected)
2002-2006 General Chairman of the 7th World Congress for Computational Mechanics held in Century City, California, July, 2006.
2002-2004 Co-Chairman of the 6th World Congress for Computational Mechanics to be held in Beijing, China, September, 2004.
2000-2002 President of US Association of Computational Mechanics (USACM) where he strengthened the organization and co-organized a new international conference with more than 1900 attendees
2001-2003 Chairman of the Engineering Panel of the Research Grants Council of Hong Kong, China
2005-2006 Chairman of Applied Mechanics Division, American Society of Mechanical Engineers, where he created three endowment funds totaling more than $170,000
2001-2005 Member of the executive committee of Applied Mechanics Division of ASME (Chairman in 2005) (Elected)
1997-2002 Associate Chairman of Department of Mechanical Engineering
1997-2001 Area Coordinator of Computational Structural Mechanics of Army High Performance Computing Research Center (AHPCRC)
1997-2002 Associate Chairman of Department of Mechanical Engineering
1997 General Chairman of McNU'97 held at Northwestern University (more than 1000 participants)
1988-present Professor, Department of Mechanical Engineering and Department of Civil Engineering, Northwestern University
1983-1988 Associate Professor, Department of Mechanical Engineering and Department of Civil Engineering (Courtesy Appointment), Northwestern University

1982-1983 Assistant Professor, Department of Civil Engineering Northwestern University
1980-1983 Assistant Professor, Department of Mechanical and Nuclear Engineering, Northwestern University
1976-1980 Research Assistant, Division of Engineering and Applied Science, Caltech
1974-1976 Research Assistant, Department of Material Engineering, University of Illinois at Chicago Circle

Professor Wing Kam Liu Narrative Research Achievements

Professor Wing Kam Liu has made fundamental, innovative contributions to the theories and methodologies of multiscale simulation-driven engineering and science through application of a spectrum of atomistic, quantum, and continuum building block strategies. His research has benefitted the understanding and design of nano-materials, polymeric material systems, engineering material systems and design of materials for (additive and flexible) manufacturing processes, biological processes, and the use of organic and inorganic materials for drug delivery systems, bio-sensing, and other diagnostic and therapeutic applications. He has developed new finite element and meshfree methods and multiscale methods that are used globally via implementation in both commercial and laboratory codes. He is the PI of a multi-year, multi-million dollar collaborative research grant from Goodyear Tire and Rubber Company to develop and integrate design strategies to enable prediction, synthesis and characterization of new polymer nano-composites to achieve enhanced performance and fulfillment of AAA requirements. Recently, he has developed a Molecular Simulation Guided Constitutive Modeling on Finite Strain Viscoelasticity of Elastomers which is adopted by Bridgestone Corporation. He has pioneered computational multiscale methods for the design and analysis of materials and material systems. In collaboration with Greg Olson, he has designed steels of unprecedented strength and toughness using the *archetype-genome exemplar* approach developed within his group. He is the first to explore the interplay between phononic bandgaps and piezoelectric microstructures for energy harvesting. Together with Cheng Sun, he has designed and fabricated mechanically *flexible* and optically *transparent* piezoelectric metamaterials that are sensitive to small vibrations for application in devices which are attractive in light of the increasing demand for vibration energy harvesting and integrated sensors and actuators.

Professor Liu has published over 400 journal and proceeding articles and his impact on the field of engineering is attested by the large number of citations to his work. In 2014, Liu is selected as a ***highly cited researcher in Computer Science*** **and** ***a member of the World's Most Influential Scientific Minds*** by Thompson Reuters for the period 2002 through 2012. In 2001 ISI identified Professor Liu as "one of the most highly cited, influential researchers in Engineering, and an original member of the highly cited researchers database." He has also authored four books: *Meshfree Particle Methods*, a definitive text on the subject; *Nonlinear Finite Elements for Continua and Structures* first and second editions (2000, 2013); the most popular text on nonlinear finite element analysis; and *Nano Mechanics and Materials: Theory, Multiscale Methods and Applications*, which has received a very favorable review by *Nanotoday* (November, 2006). Recently, his research has been focusing on three fronts: (1) the new *Archetype-Blending Multiresolution Theory for Microstructured Materials and Materials Design for Additive Manufacturing*, connecting *Multiscale Mechanics to Microstructural Design Parameters;* (2) the *Immersed Molecular Electrokinetic Finite Element Method* for modeling the *microfluidic electrokinetic assembly of nano wires and filaments as well as bio-molecules that can* enable drug delivery systems to achieve desired therapeutic effects (nano-medicine)*;* (3) *flexible phononic piezoelectric metamaterials* that can achieve superior electromechanical energy conversion of polymer-based piezoelectric metamaterials featuring simultaneous energy harvesting capabilities along with sensing and actuating device flexibility.

Among Professor Liu's most noteworthy contributions are: (1) Development of multiscale methods that bridge the scales from quantum to the macroscale, including new interfaces between scales for concurrent coupling to minimize spurious reflections. Using these methods, he has developed software for the design and use of nano-particles in materials design, manufacturing, bio-sensing, and drug delivery. (2) Consultant and PI of a multi-year

collaborative research grant from Goodyear Tire and Rubber Company to develop and integrated design strategy to enable prediction, synthesis and characterization of new polymer nanocomposites to achieve enhanced performance and fulfillment of AAA labeling requirements. A computational multi-scale modeling strategy using science-based methodology for prediction of tanδ based on chemistry of constituents has been developed. A virtual lab design through predictive multi-scale analysis is going to be developed for accelerating the synthesis of new polymer nanocomposites. (3) Development of new shell elements, arbitrary Eulerian-Lagrangian methods and explicit-implicit integration techniques that have significantly enhanced the accuracy and speed in software for crashworthiness and prototype simulations; and he was the first to develop nonlinear probabilistic FE techniques that made nonlinear stochastic and reliability analyses possible. (4) Development of new meshfree formulations, known as reproducing kernel particle methods, providing exceptional accuracy for the simulation of solids undergoing extremely large deformation. These contributions have been implemented in many commercial and laboratory software systems. Among them are: (a) Shell elements in DYNA3D, ABAQUS, LS-DYNA, ANSYS, and Argonne National Laboratory (ANL) software; (b) Explicit/implicit methods in US Ballistic Laboratory EPIC-2/EPIC-3 programs, and ANL software; (c) Lagrangian-Eulerian methods adopted by ANL, Kawasaki, Mitsubishi, Ford Motors, and Grumman; (d) Various meshfree methods implemented by Sandia National Labs, Lawrence Livermore National Lab, General Motors, Ford Motors, Delphi, Ball Aerospace, and Caterpillar; (e) Multiscale methods adopted by Goodyear for the design of tires and by Sandia.

Professor Liu's research results have also been applied in materials and material systems design, design of nanoparticle-mediated drug delivery, surface engineering, additive and flexible manufacturing processes, computational fluid dynamics, fluid-structure interaction, safety analysis of nuclear reactors, seismic analysis, and probabilistic fracture and fatigue problems.

Professor Liu is the Walter P. Murphy Professor of Mechanical Engineering at Northwestern University, Director of Advanced Material Systems and Simulations Global Collaboratory, Director of International Research Center for Computational Mechanics at Dalian University of Technology, Chair Professor of Peking University, Program for Overseas Professionals (Thousand Talent Project), Honorary Professorship of Dalian University of Technology, Past Chair (Chair 2015-2016) of the US National Committee on TAM within the National Academies, President of IACM, Founding Director of the NSF Summer Institute on Nano Mechanics, Nano Materials, and Micro/Nano Manufacturing, Founding Chairman of the prestigious ASME NanoEngineering Council, and Founding Co-Director of the Northwestern University Predictive Science and Engineering Design Program.

Recently, Professor Liu, the Founding Director, led the development of the Master of Science (MS) in Simulation-Driven Engineering (SDE) specialization program between ME and CEE departments. SDE represents industry-specific specializations with an appeal to students preparing for mechanical, design, manufacturing, structural, geotechnical and aerospace engineering careers. The mission is to teach MS students and professionals the fundamentals and applications of simulations-driven engineering with industry-specific specializations in mechanical, design, manufacturing, structural, geotechnical and aerospace engineering.

He was also an adjunct professor under the Distinguished Scientists Program Committee at King Abdulaziz University, Jeddah, Saudi Arabia. He was a Visiting Distinguished World Class University Professor of Sung Kyun Kwan University (SKKU), Korea, and is a Visiting Chair Professor of the SKKU Advanced Institute of Nanotechnology (SAINT) which is supported heavily by Samsung Electronics focusing on nano/biotechnology. He has served as a Visiting Nanyang Professor in the Nanyang Technological University of Singapore, University of Reims, France, École normale supérieure (ENS) de Cachan, France, and many others. He is the editor of the *Journal of Computational Mechanics* and the *International Journal of Applied Mathematics and Mechanics*, the honorary editor-in-chief of the *International Journal of Computational Methods*, has served on numerous journal editorial boards, and has been a consultant to more than 20 governmental and international organizations.

Professor Liu is an elected life fellow of the American Society of Mechanical Engineers (ASME) and the American Society of Civil Engineers (ASCE), fellow of the American Academy of Mechanics (AAM), the United States Association for Computational Mechanics (USACM) and the International Association for Computational Mechanics (IACM). He is currently the President of IACM. He was previously the Chairman of the ASME Applied Mechanics Division and during which time he created three endowment funds totaling more than $170,000. He was also President of USACM (2000-2002) where he strengthened the organization and was the General Chairman of the 2006 7th World Congress for Computational Mechanics (WCCM) held in Century City, CA, with about 2000 attendees. He was the Co-Chairman of the 6th WCCM held in Beijing, China, 2004, and the General Chairman of McNU'97 held at Northwestern University in 1997 with 1000 participants. He is the Founder and Co-Chair of the 2010 First World Congress on NanoEngineering for Medicine and Biology.

Professor Liu has received numerous major awards and honors including: the 2014 as a highly cited researcher in Computer Science and a member of the World's Most Influential Scientific Minds by Thompson Reuters; the 2013 Japan Society for Computational Engineering and Science Grand Prize in recognition of his outstanding contributions in the field of computational mechanics (bestowed in 2014); the Honorary Professorship (this title is similar to an Honorary Doctor's Degree) Dalian University of Technology in 2013; the 2012 Gauss-Newton Medal (IACM Congress Medal); the highest award given by IACM; the 2012 ASME Design Automation Conference Best Paper Award; the 2009 ASME Dedicated Service Award; the 2007 ASME Robert Henry Thurston Lecture Award; the 2007 USACM John von Neumann Medal; the 2004 Japan Society of Mechanical Engineers (JSME) Computational Mechanics Award; the 2002 International Association for Computational Mechanics (IACM) Computational Mechanics Award; the 2001 USACM Computational Structural Mechanics Award; the 1995 ASME Gustus L. Larson Memorial Award, the 1985 ASME Pi Tau Sigma Gold Medal; the 1979 ASME Melville Medal (for best paper); the 1989 Thomas J. Jaeger Prize of the International Association for Structural Mechanics, and the 1983 Ralph R. Teetor Educational Award from the American Society of Automotive Engineers. Liu is an elected life fellow of ASME and ASCE, fellow of AAM, USACM and IACM. He obtained his M.S in 1977 and Ph.D. in 1981, both from California Institute of Technology. In 1976, He obtained by B.S with the highest honor from the University of Illinois at Chicago Circle. He is a Registered Professional Engineer for the State of Illinois.

Research Areas

Linear and onlinear finite elements, multiscale methods for materials and material systems design, engineering simulation for manufacturing processes
Meshfree particle methods, reproducing kernel particle methods, multiscale peridynamics
Linear and Nonlinear Fluid Structure Interactions
Seismic Analysis and Vulnerability of Structures
Computational Nanotechnology
Multiscale Computational Materials Design for Additive Manufacturing
Computational Multiscale Fracture
Microfluidics and electrokinetics of manipulation and assembly of nano/bio molecules
Modeling of MEMS/NEMS and energy harvesting Devices
Microfluidic electrokinetic assembly of nano- and bio-molecules
Computational design and analysis of nanodiamond-polyethylenimine-gene/drug delivery
Computational design and analysis of drug delivery in microvasculature
Nano-medicine
Multi-functional theory and finite element analysis and design of acoustic and phononic metamaterial isolation, energy harvesting, and sensing
Finite element and multiscale analysis of nano-polymer composite for rubber and ties industries

Professional Services

2014-2018 President of the International Association for Computational Mechanics

2014-2016 Chair of the US National Committee on Theoretical and Applied Mechanics within the National Academies
2013- Present Advisory Council Member for the Committee on Credible Practice of Modeling & Simulation in Healthcare, Interagency Modeling and Analysis Group Multiscale Modeling Consortium, (https://simtk.org/home/cpms)
Podcast: Multiscale modeling and simulation using nano diamond materials, August, 2012 https://www.asme.org/engineering-topics/media/nanotechnology/podcast-wing-kam-liu-modeling-simulation
Co-Chairman of the First World Congress on NanoEngineering for medicine and biology (NEMB2010): Advancing Health Care through NanoEngineering and Computing, Feb 7-10, 2010, Houston, TX. (http://www.asmeconferences.org/nemb2010/)
General Chairman of the 7th World Congress on Computational Mechanics, Century Plaza Hotel and Spa, July 16-22, 2006, where he strengthened the organization and co-organized a new international conference with more than 1900 attendees.
Co-Chairman of the 6th World Congress on Computational Mechanics, Beijing Hotel, Beijing, China, September 5-10, 2004
General Chairman of McNU'97, The 1997 Joint American Society of Mechanical Engineers (ASME) /American Society of Civil Engineers(ASCE)/Society of Engineering Science (SES) Summer Meeting, sponsored by McCORMICK School of Engineering, Northwestern University, ASME Applied Mechanics Division (AMD), ASME Materials Division (MD), ASME Manufacturing Engineering Division (MED), ASCE Engineering Mechanics Division (EMD), Society of Engineering Science (SES), Army High Performance Computing Research Center (AHPCRC), Chicago Section of Society of Automotive Engineers (SAE), Institute for Mechanics and Materials (IMM), University of California, San Diego, ISUZU Advanced Engineering Center, LTD, Kanagawa-ken, JAPAN, National Science Foundation, Office of Naval Research, held on June 29 - July 2, 1997, at Norris Center, Northwestern University. 210 sessions with 1024 papers, and 1050 participants from 43 countries.
President of U. S. Association for Computational Mechanics, (Elected) 2000-2002
Chairman and Member of the executive committee of Applied Mechanics Division (AMD) of ASME
(Chairman in 2005), where he created three endowment funds totaling more than $170,000 and co-founded and currently chair of the newly established ASME Nanotechnology (renamed NanoEngineering) Council.
Member of ASME AMD Timoshenko Medal Committee, 2001 - 2010
Member of ASME AMD Warner T. Koiter Medal Committee, 2001 – 2010
Member of ASME AMD Daniel C. Drucker Medal Committee, 2001 – 2010
Member of ASME AMD Young Investigator Award Committee, 2001 – 2005
Member of ASME AMD Applied Mechanics Award Committee, 2001 - 2005
Member of the International Association for Computational Mechanics General Council, (Elected), 1994-
Vice President of U. S. Association for Computational Mechanics, (Elected) 1998-2000
Treasurer of U. S. Association for Computational Mechanics, (Elected) 1996-1998
Secretary of U. S. Association for Computational Mechanics, (Elected) 1994-1996
Chairman of Computing in Applied Mechanics Committee, ASME, 1993-1995
Vice-Chairman of Computing in Applied Mechanics Committee, ASME, 1991-1993
Program Chiarman of the First US National Congress for Computational Mechanics, 1991.
Member at Large of U. S. Association for Computational Mechanics, 1991-1994
Vice-Chairman of Computational Mechanics Committee, ASCE, 1987-1988 and 1990-1991
Chairman of Computational Mechanics Committee, ASCE, 1988-1990
Member of the Control Group, ASCE, 1986-1991
Treasurer, American Academy of Mechanics, 1983-1988
Judge for National and Regional Robotic Competitions for FIRST, 1997-

Committee on Computational Mechanics, Engineering Mechanics, ASCE, 1983-1992

Committee on Computing in Applied Mechanics, ASME, 1981-present
Committee on Pressure Vessel Piping, ASME, l986-present
Committee on Junior Awards, Applied Mechanics Division, ASME, 1987-1994
Committee on Elasticity, Engineering Mechanics, ASCE, 1989-present
Reviewer, American Nuclear Society
Reviewer, Journal of Applied Mechanics, ASME
Reviewer, Journal of the Engineering Mechanics Division of the ASCE
Reviewer, National Science Foundation
Reviewer, Computer Methods in Applied Mechanics and Engineering
Reviewer, Journal of Heat Transfer, ASME
Reviewer, Journal of Nuclear Engineering and Design
Reviewer, International Journal of Numerical Methods in Engineering
Reviewer, Applied Mechanics Reviews
Reviewer, Journal of Aircraft, AIAA
Reviewer, Journal of Engineering with Computers
Reviewer, Mechanics Research Communications - Basic and Applied
Reviewer, Computational Mechanics
Reviewer, International Journal for Numerical Methods in Fluids
Reviewer, SIAM Journal of Applied Mathematics
Reviewer, Finite Elements in Analysis and Design
Reviewer, Journal of Computational Physics
Reviewer, Journal of Physical Chemistry
Reviewer, Journal of the Mechanics and Physics of Solids
Reviewer, International Journal of Solids and Structures
Panel Review for National Science Foundation
Reviewer, Department of Energy
Reviewer, Hong Kong Research Grants Council
Reviewer, Korea Science and Engineering Foundation
Panel Review for Texas Higher Education Coordination Board, Austin, Texas

Consulting
Hughes, Inc., Palo Alto, California
ZACE Services S.A. Lausanne, Switzerland
Argonne National Laboratory, Principal Consultant, Reactor Analysis and Safety - Applied Physics, Argonne, Illinois
USA Ballistic Research Laboratory, Penetration Mechanics Branch,
Aberdeen Proving Ground, Maryland (a subcontract from Battelle Columbus Laboratories).
Perma-Pipe, Division of Midwesco, Inc., Niles, Illinois
Grumman Aerospace Corporation, Bethpage, New York
International Advisory Panel, Chinese University Development Project, National Academy of Sciences, Washington, D.C.
Polaroid, Waltham Office
National D'Etudes Et De Recherches Aerospatiales, Paris, France, appointed by Advisory Group for Aerospace Research and Development, North Atlantic Treaty
Centro Ricerche Fiat, Torino, Italy
Mitsubishi Heavy Industries, Ltd., Nagasaki, Japan
Kawasaki Heavy Industries, Ltd., Tokyo, Japan
Centric Engineering Inc., Palo Alto, California
Law Offices of John Scott Hoff, P. C.
Fel-Pro Inc., Skokie, Illinois
Cornelius, Glendale Heights, Illinois, (IMI Cornelius Inc., Anoka, Minnesota)
Bell and Howell, Skokie, Illinois
Snap-On Tools, Kenosha, WI
Sandia National Laboratory, Al, NM.

Air Force Research Lab, Al, NM. (AFRL/DEPE) Subcontract from Ball Aerospace & Technologies Corp., Systems Engineering Operations, Al, NM and San Diego, CA.
The Goodyear Tire & Rubber Company, Akron, OH.
CFD Research Corporation, Huntsville, AL
TNO Defence, Security and Safety, Rijswijk, the Netherlands
Sentient Corporation, USA
Anthem Products Group, Chicago, Illinois, USA
Caulfield Engineering Inc, Illinois, USA

University Services
Committee on Manufacturing Engineering Education
MEAS Computer Committee Computer System
Committee on Academic Standing
Mechanics Seminars Coordinator, 1995-1996
Promotion and Tenure Committee, 1997-
Committee to Review Junior Faculty Appointments, 1998-
Chair of the ME Faculty Search Committee on Nano/MEMS, 1999-2000
Chair of the ME Faculty Search Committee on CAD/Virtual Reality, 2002-2003

Teaching
Static and Dynamics
Applied Stress Analysis
Computational Fluid Dynamics I and II (two new courses developed for Dept. of ME)
Computer Analysis and Synthesis of Mechanical Systems (new course developed for Dept. of ME)
Computer Aided Mechanical/Structural Design (new course developed for Dept. of ME)
Finite Element Methods
Advanced Finite Element Methods I
Advanced Finite Element Methods II (new course developed for Dept. of CE)
Special Topics in Mechanical Engineering
Special Topics in Computational Mechanics
Computational Nano- Micro- and Macro- Mechanics (New Course)
Molecular Modeling and the Interface to Micromechanics (New Course)
Multiscale Modeling and Simulation for Solids (New Course)
NSF Summer Institute on Nano Mechanics and Materials, June, 2004, “Multiple Scale Simulation Methods for Nano Mechanics and Materials.”

Grants
Principal Investigator
NSF: "Research Initiation" Dynamic and Buckling Analyses of Liquid Storage Tanks," June 1, 1981 to September 30, 1982 ($48,000).
NASA: "Mixed Time Integration Methods for Transient Thermal Analysis of Structures," October 1, 1981 to September 30, 1982 ($36,235).
NSF: "Numerical Quadrature Schemes for Nonlinear Structural Dynamics," May 15, 1985 to October 31, 1987 ($150,763).
NASA: "Variational Approach to Probabilistic Finite Elements," May 1, 1984 to August 31,1987 ($211,086).
NSF: "Dynamic and Buckling Analyses of Liquid-Filled Tanks," May 1, 1983 to October 31,1985 ($115,501).
NSF: "Investigation of Failure of Liquid Storage Tanks," January 1, 1987 to December 31, 1989 ($82,662).
ONR: "Probabilistic Acoustics of Fluid-Composite-Shell Systems," August l5, l987 to August 14, l989 ($l55,300).

NSF: "Adaptive ALE Finite Element for Material Forming Simulations," November 1, 1988 to April 30, 1991 ($186,535).
NASA: "Probabilistic Finite Elements for Fatigue and Fracture Analysis," February 1, 1988 to March 31, 1992 ($252,029).
Chrysler: "Performance Investigation of Hydroelastic Mounts," September 1, 1991-August 31, 1993, ($170,902).
NSF: "Adaptive Finite Element Methods for Unsteady Lubricated Metal Forming Processes," April 15, 1995- December 31, 1996 ($24,990).
Power Reactor and Nuclear Fuel Development Corporation and others ($38,484).
NSF: "Multi-Scale Methods for Structural Dynamics", June 15, 1991-May 31, 1993 ($100,717).
G.E: "Casting Filing Simulations of Thin Walled Cavities", May 16, 1990- May 14, 1992 ($77,051).
AFSOR: "Multiple Scale Methods for Stability Analysis of Fluid-Structure Systems", September 15, 1992-September 14, 1993 ($48,380).
ARO: "Multiple Scale Methods for Nonlinear Dynamic Flaw Structures", July 1, 1992-December 31, 1992 ($19,997).
ONR: "Multiple Scale Methods for Medium Frequency Complex Structures", 3/15/94-3/14/95,($82,560).
Tull Family Endowment ($1,000,000.00) In 1994 Mr. Chu Tull donated $300,000 to endow the Chu Tull Computational Mechanics Fellowship, which provides for graduate study in computational mechanics. In 1997, Mr. Tull has added a $700,000 gift to his previous donation, bringing the total to $1 million.
FORD-GIFT: "Development of a Solid Element with Finite Elastic-Plastic Strains", September 1, 1995, ($65,000).
AFOSR: "Multiple Scale Reproducing Kernel Methods for Compressible Flow-Structure Interaction," April 1, 1995 to March 31, 1996 ($79,717).
ONR: "Multiple Scale Particle Methods for Complex Structures," April 1, 1995-March 31, 1998, ($386,912).
AFOSR: "Multiresolution Analysis of Compressible Viscous Flow-Structure Interaction," May 1, 1996 - April 30, 1999 ($281,884).
NSF: "Structure Dynamics by Multiple Scale Analysis," September 1, 1996-August 31, 2000 ($150,000).
AHPCRC: "Computational Structural Mechanics--Research", August, 1, 1997-January 8, 2000, ($305,202)
AHPCRC: "Computational Structural Mechanics--Support", August, 1, 1997-January 8, 2000, ($86,226)
AHPCRC: "Computational Structural Mechanics—Technology Transfer Support", January 9, 1998 -January 8, 2000, ($204,915).
FORD-GIFT: "Sheet Metal Forming", April 1, 1998, ($48,000).
AHPCRC: "Computational Structural Mechanics--Equipment Support", May 1, 1998 - December 31, 1998, ($117,000).
NSF: "McNU'97, The 1997 Joint American Society of Mechanical Engineers (ASME)/American Society of Civil Engineers(ASCE)/Society of Engineering Science (SES) Summer Meeting, June 29 - July 2, 1997, at Norris Center, Northwestern University." October, 1, 1996- September 30, 1997 ($4,500).
ONR: "McNU'97, The 1997 Joint American Society of Mechanical Engineers (ASME)/American Society of Civil Engineers(ASCE)/Society of Engineering Science (SES) Summer Meeting, June 29 - July 2, 1997, at Norris Center, Northwestern University." December 1, 1996-November 30, 1997 ($4,500).
Ford Motors: "Development of a Solid Element for Sheet Metal Forming", $48,000.
Ford: "Triangular Elements and improvements in spectral fidelity for crash program," ($91,631).
NSF: "The Third International Conference on Fracture, Corrosion, and Fatigue held in Hong Kong, December 1997." March 1, 1997-February 28, 1998 ($ 15,000).

NSF/Subcontract from University of Iowa: "Efficient Meshless Methods for Unsteady Lubricated Metal Forming Processes", 9/15/97-8/31/2001 ($ 124,984).
Ball Aerospace: "Meshfree Software Development," $30,000.
ONR: "CyberSteel 2020: Naval Materials by Design" ($2,068,589), 6/15/01- 6/14/06.
NSF: "LCE: Simulation-based design environment by meshfree-particle methods," 10/1/99-9/30/2003, ($180,039)
Univ of Iowa: "Meshfree Workshop," $10,500.
Sandia: "Non-Local particle method for simulation of Failure, Fracture & Fragmentation," 6/1/2000 – 9/30/2000, ($50,054).
Belytschko Symposium, $16,785.
NASA Langley: "Deployment of Inflatable Structures by ALE FEM," ($71,126) 5/1/02-4/30/03.
NSF: "Summer Institute on Nano Mechanics and Materials," ($294,469) 4/1/2003-3/31-2006.
NSF: "Summer Institute on Nano Mechanics and Materials, Supplement," ($25,000) 8/1/2003-3/31-2006.
NASA: "Computational Approaches for the Inflation Deployment of Solar Sail Boom," $75,151, 2003-05-15 - 2006-05-14.
NASA: "Advanced Computational Models & Software for Design & Simulation of Solar Sails Including Exp. Validation," $64,536.00, 10/1/03 – 11/30/04.
NSF: "Modeling of Nanoscale Systems," $243,509, 8/1/03-7/31/06.
Summer Institute: $21,800.
NSF: Experimental and Multi-Scale Modeling Investigation of Atomic Lattice Stick-Slip Friction, 7/1/04 – 6/30/07. $ 189,977.00.
NSF: (REU Supplement) Modeling of Nanoscale Systems, $6,000.00.
World Congress on Computational Mechanics Conference 2006, $810,000.00.
NSF: "Summer Institute on Nano Mechanics and Materials," ($225,691) 4/1/2006-3/31-2008.
NSF: "Wafer scale bio/nano filament assembly, ($299,999)," July 1, 2005 to June 30, 2007.
ONR/DAPRA: Subcontract from Questek, "Advanced Tools for Computational Materials Engineering," ($766,717) June 27, 2005 to June 15, 2010.
Sandia National Lab., Multiresolution Analysis for the Mechanics of Materials, $390,000, 10/1/06-9/30/09
NSF: REU Supplement for Collaborative Research: Experimental and Multi-Scale Modeling Investigation of Atomic Lattice Stick-Slip Friction, $6,000, 04/05/2007 ~ 06/30/2008.
NSF: US-Taiwan Workshop on Simulation Based Engineering & Science, $48,000, 1/1/08-12/31/09.
NSF: Computational Multiresolution Mechanics of Solids and Structures, $150,000, 9/1/08-8/31/10.
NSF: Modeling of Endothelial Cell Adhesion Dynamics Modulated by Experimental Molecular Engineering, $370,989, June 15, 2009 to May 31, 2012.
Goodyear Tire and Rubber Co: Compound Multiscale Modeling for Predictive Tread Materials Design and its continuations (PI: W.K. Liu); **Total Award: $2,926,908.00 (6/1/2009 to 9/30/2013)**; 6/1/2009 to 8/31/2013. (Compound Multiscale Modeling for Predictive Tread Materials Design, $1,042,896.00, June 1, 2009 to November 30, 2010; $868,353, January 1 2011 to December 31, 2011; $132,722, September 1 2011 to December 31, 2011, $50,000 plus $806,934 May 24, 2012, $14,003.00, May 1 2013, $15,000, TEM, Sept 2013).
International Union of Theoretical and Applied Mechanics (IUTAM), $6,000, May 2010.
US National Academies, $2,500, June 2010.
International Union of Theoretical and Applied Mechanics (IUTAM), $4,600, April 2014.
Bridgestone: Multi-scale Material Modeling for Filled Rubber, $240,000, September 1, 2015 to August 30 2018.
General Electric Digital Manufacturing Design Innovation Institute (DMDII) Project: Elastic Cloud Based Make, $450,000.00 (including cost share), April 1, 2016 to March 31, 2017.

Co-Principal Investigator
NSF: "Stability and Improvement of Explicit Time Integration Procedures for Structural Dynamics," September 1, 1982 to March 31, 1985 ($129,173).
ARO: "Study in Penetration Mechanics with an Arbitrary Lagrangian Eulerian Finite Element Code," May 1, 1984 to September 30, 1986 ($168,917).
ARO: "Transient Algorithms, Element Technology and Erosion Models for Three Dimensional Penetration Mechanism Codes," March 1, 1987 to February 29, 1990 ($240,514).
ARO: "Finite Element Technology for Penetration Problems," January 1, 1991-March 31, 1994 ($240,000).
NSF: "REG: Mini-Supercomputer," July 1, 1991-March 31, 1992 ($60,645).
ONR: "Computational Methodologies for Fluid-Structure Modeling of Underwater Explosions," January 1, 1993 - December 31, 1996 ($563,380).
ONR: "Computational Methodologies for Fluid-Structure Modeling of Underwater Explosions, AASERT" January 1, 1993 - July 31, 1996 ($262,806).
ARO: "Gridless Computational Methods for Penetration Mechanics," April 1, 1995 to February 28, 1998, ($225,000).
NSF: "Non-Destructive Evaluation of Critical Bridge Components," October, 1, 1995-September 30, 1996, ($100,000).
Northwestern University Tribology Center: "Finite Element Method for Lubricated Contact", Starting January 1997, ($ 42,000).
NSF: "Engineering Research Equipment: Parallel Workstations", 9/15/97-2/28/99, ($120,970 plus $60,500 matching funds, total = $181,470).
ARO: "Gridless Methods for Contact", 6/1/97-5/31/2000, ($99,999).
TransMotive Technologies, Inc./Subcontract from DTRA - Defense Threat Reduction Agency (Formerly DSWA), "Meshfree Methods for Structural Dynamics", 10/1/97-9/30/2000, ($631,544).
ARO: "Meshfree Methods for Failure Analysis", 4/1/98-8/31/01, $ 255,001.
Ford Motors: "A Fast and Accurate Axisymmetric Element and Design Algorithm for Optimizing Stamping Steps of Axisymmetric Parts," $ $85,234.
Ford: "Triangular Elements and improvements in spectral fidelity for crash programs," ($91,631).
ONR: "Manipulating Chemical, Electrical and Mechanical Properties of Nanofilaments for MIS," ($920,001), 4/1/01-3/31/04.
General Atomic: "Development and Application of Meshfree Methods" ($186,943), 4/1/2001-9/30/03
NSF: "A Multi-scale Approach for Predicting Wrinkling and Its Experimental Validation", ($359,997), 9/15/01-9/14/04.
NSF: "IGERT, On a Virtual Tribology System" ($2,700,000), 9/15/01 – 8/31/06.
N**SF:** "Mechanics of Nanoropes" ($320,000), 5/1/02 – 4/30/05.
ARO: "Multiscale Meshless Method for Material Failure," ($270,000), 8/1/02-7/31/05
NSF: "GOALI/Collaborative Research: Microforming Processes - Fundamental Studies and Development," 7/1/04 – 6/30/07, $ 320,111.00.
ONR: "Nanofilament-Based Combined C/B Detectors," $516,127.00, 10/01/03 – 9/30/2006.
ARO: "Multiscale Meshless Analysis of Shear Bands: Local Partitions of Unity and Generalized Gradient Methods," $272,920. 10/1/2007-9/30/2010.
DoE: (Subcontract from MSU), Failure Analysis of Braided Composite Tubes, $164,370, 02/01/2007 ~ 01/31/2009
NSF: Summer Institute on Nano-Mechanics, Nano-Materials and Micro/Nano-Manufacturing, 558,322.00, 10/01/07-9/30/12
NSF: Supplement to Summer Institute on Nano-Mechanics, Nano-Materials and Micro/Nano-Manufacturing, $20,000, 5/18/09-9/30/12
NSF: Integrative Modeling/Simulation and Experimental Validation of Therapeutic Nanodiamond Materials, $1,131,220.00, 6/01/09 to 5/31/14.

NSF: Stochastic Multiscale Computational Design Methodology, $380,000, 9/1/2009 to 8/31/2012.
NSF IDR: Engineering Electroactive-Polymer-Based Phononic Crystals as a Sustainable Energy Source, $599,095, September 1, 2011 and expires August 31, 2015.
NIST/NIU: Rapid Qualification & Certification (RQC) Using Calorimetric, Optical, Mechanical, Microstructural (COMM) Validation, $1,199,341.00, October 1, 2013 to September 30 2015.
AFOSR: ABC Stochastic Multiresolution Theory for Microstructure Based Predictive Materials Science: Application to Multiphase Polymer Systems, $926,183.00, December 1, 2013 to November 30, 2016.
NIST: Co-PI of Center for Hierarchical Materials (CHiMaD, http://chimad.northwestern.edu/), $25,000,000.00 plus cost shares, 1/1/2014 to 12/31/2018.
DoE/Ford Motor Company: Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles, 10/1/2014 to 9/30/2018. ($2,858,691.00=$2,002,401.00+$857,290.00).
Digital Manufacturing Design Innovation Institute (DMDII) Project Call DMDII 15-07; Rapid process certification and verification for high value-added and low-volume production (cost negotiation)
ARO Physically-based tempered fractional-order operators for efficient multiscale simulations, $481,684, July 15, 2015 to June 30, 2019
NSF CPS, Synergy: An Integrated Simulation and Process Control Platform for Distributed Manufacturing Process Chains, 12/01/2016 – 11/30/2019, $701,323.00.

Journal Articles and Chapters in Books

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T. J. R. Hughes and Wing K. Liu, "Implicit-Explicit Finite Elements in Transient Analysis: Implementation and Numerical Examples," Journal of Applied Mechanics, 45, pp. 375-378, 1978.

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T. J. R. Hughes and W. K. Liu, "Nonlinear Finite Element Analysis of Shells: Part I - Three-Dimensional Shells," Computer Methods in Applied Mechanics and Engineering, Vol. 26, pp. 331-362, 1981.

T. J. R. Hughes and W. K. Liu, "Nonlinear Finite Element Analysis of Shells: Part II - Two-Dimensional Shells," Computer Methods in Applied Mechanics and Engineering, Vol. 27, pp. 167-182, 1981.

W. K. Liu, "Finite Element Procedures for Fluid-Structure Interactions and Applications to Liquid Storage Tanks," Nuclear Engineering and Design, Vol. 65, No. 2, pp. 221-238, 1981.

T. J. R. Hughes, W. K. Liu and T. K. Zimmerman, "Lagrangian-Eulerian Finite Element Formulations for Incompressible Viscous Flows," Computer Methods in Applied Mechanics and Engineering, Vol. 29, pp. 329-349, 1981.

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Wing K. Liu, and T. Belytschko, "Mixed-Time Implicit-Explicit Finite Elements for Transient Analysis," Computers and Structures, Vol. 15, pp. 445-450, 1982.

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Special issue of International Journal for Numerical Methods in Engineering, entitled "Meshfree Methods" edited by Wing Kam Liu, Sergio R. Idelsohn and Eugenio Oñate.

Special issue of Computational Mechanics, entitled "Meshfree Particle Methods" edited by J. S. Chen and Wing Kam Liu, vol. 25, pp. 99-305, 2000.

Computer Codes

NIOSH A computer program for the Acquisition of three-dimensional coordinate data of a collection of object points from their observed image locations.

GAMA A three-dimensional Large Displacement Analysis Computer Program of Human Spine and Torso.

LEARN A linear Static and Dynamic Finite Element Analysis Computer Program. (Based on LEARN - a Linear Static Finite Element Analysis Program, by T. J. R. Hughes, 1977, California Institute of Technology). This program is implemented with reduced and selective integration option; explicit time integration.

STEADY A steady state Finite Element Computer Program for two-dimensional incompressible viscous fluid flow and heat transfer. This program is implemented with multi-levels options.

TFLUID A time-dependent Finite Element Computer Program for two-dimensional and three-dimensional axisymmetric incompressible viscous fluid dynamics with the capability of arbitrary Lagrangian-Eulerian formulation. This program is implemented with multi-levels and variable time steps options.

SHELL A linear and nonlinear Finite Element Computer Program for two-dimensional, three-dimensional axisymmetric and three-dimensional Large/Small Displacement and Buckling Analysis of Shells.

FLUSTR A General Purpose Linear and Nonlinear, Static and Dynamic Finite Element Solid-Fluid-Structure Interaction Analysis Computer Program. This program is implemented with the Mixed Lagrangian-Eulerian formulation and sliding interface capabilities. Both geometrical and different type of material nonlinearities such as nonlinear elasticity, isotropic, kinematic and combined isotropic and kinematic plasticity, etc. are considered.

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